

# *Power* Where You Need It

## *The Promise of Photovoltaics*

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Sandia  
National  
Laboratories

## CONTENTS

Lofty Beginnings.....	2
Down to Earth.....	3
Commercial Applications.....	4
Grid Connected Residential.....	8
Stand Alone Residential .....	12
Agricultural Uses .....	14
Facility Power .....	16
Lighting.....	18
Security Lighting .....	20
Transportation.....	22
Navigational Aids .....	24
Other Infrastructure .....	26
Telecommunications.....	28
Utility Applications .....	30
Military Uses .....	34
Environmental Aids.....	36
Disaster Mitigation and Relief .....	38
Public Health and Safety .....	40
Recreational Needs .....	42
Making Everyday Life Better .....	44
Still Flying High .....	46
Contributors.....	47
Index .....	50

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*Cover Photo:* Fetzner Vineyards, one of the largest wine makers in the United States, has decided to run all its operations from electricity generated by renewable energy. Read more about this photovoltaics installation on page seven. *[Photo courtesy AstroPower, Inc.]*

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# Power Where You Need It:

## *The Promise of Photovoltaics*

**F**or more than twenty years Sandia National Laboratories has been involved in helping establish successful programs and partnerships with members of the photovoltaics community in the United States. In large part, Sandia's efforts have fallen within the realm of engineering expertise and systems excellence. Because those efforts have been documented in numerous technical publications disseminated by the tens of thousands to industry, government agencies, educational institutions, and interested individuals, the installations with which Sandia has assisted are well known. *Power Where You Need It* is unique in that it also features dozens of installations with which Sandia has had little or no connection, except that those installations came about, in the end, because U.S. Department of Energy funding through its National Photovoltaics Program helped foster their existence. Sandia's technical expertise in systems engineering created the overarching technical framework under which many of these PV installations were made possible. Sandia, along with the National Renewable Energy Laboratory, is a partner in the National Center for Photovoltaics, which is the Department of Energy's focus organization for carrying out its National Program. Some of the installations featured in this book were made possible through various programs at the Department of Energy, but many were not. Many were simply the result of an enthusiastic end user making a vital business connection with one of the thousands of spirited members of the U.S. Photovoltaics Community. This book is dedicated to all of them. May something depicted here spur your imagination to make PV a part of the world around you.



△ Walking the talk...Secretary of Energy Bill Richardson helps inaugurate a photovoltaic system at DOE headquarters—Washington, D.C.'s Forrestal Building. [Photo courtesy National Renewable Energy Laboratory]

<△ The 15kW photovoltaic system at the Pentagon. The system is the largest installation of ac modules in the U.S.—operating at the largest office building in the world. The project is a joint effort of the Department of Defense and the Department of Energy. [Photo courtesy Ascension Technology]

Photovoltaics is a universal power source. Though still a young technology, its strength is that it can be used anywhere. This book strives to highlight the myriad ways in which photovoltaics is already being used—then expand the ways we use photovoltaics (PV). PV is an enabling technology—and it can enable us to do things never dreamed of before.

Photovoltaics—often called “solar electricity,” is the direct conversion of sunlight to electricity. When sunlight strikes a PV cell, electrical current and voltage are created—silently and cleanly. Because of this, PV is one of the most attractive alternative energy forms. The modern PV cell was developed in the mid-1950s. Shortly thereafter, it powered our first space satellites, and after several decades many of these PV-powered systems are still operating—a great witness for the reliability of this power source.

Terrestrial use began to be encouraged by the U.S. government in the early 1980s. These early projects sought to prove PV’s reliability and competitiveness in practical field applications. Some of those early applications, such as the Coast Guard’s aids to navigation, were embraced immediately. Today PV is the prime power source for all of the U.S. Coast Guard’s navigational aids. Likewise, other military and governmental applications have proven irreplaceable, remote meteorological monitoring for example.



△ Photovoltaic cells were first used in space to power a 5mW backup transmitter on the Vanguard 1 in 1958. Sputnik used PV. Indeed, solar cells power most satellites in space today, and the U.S. shuttle fleet uses PV to generate much of its electrical power [Photo courtesy National Renewable Energy Laboratory from a Lockheed rendition]



Enormous growth in terrestrial photovoltaics has occurred. The 21st century opens with the United States dominating the world market in PV manufacturing and technology. A presidential initiative has suggested we can have solar systems on a million U.S. roofs by 2010. The world's first PV-powered neighborhood in Gardner, Massachusetts spawned neighborhoods throughout the country, Sacramento, California being a prime example. Utility deregulation has made it possible for home-owners to install PV and sell back to their utility that portion of power generation beyond their daily needs. PV as a power source in remote areas not served by a utility was attractive from the outset and continues to create hungry markets for photovoltaics.

▽ Electric Sunflowers, a photovoltaic array in California, designed by Solar Design Associates [Photo courtesy Solar Design Associates, Inc.]



There are few limits to PV as a power technology. Anything that requires electricity can be powered with PV. It has become the power of choice for a vast number of telecommunications challenges worldwide.

In a fragile environment, it is often the only appropriate technology. Increasingly,

it is the power of choice for utilities, commercial entities, and informed individuals.

So expand your thinking. Imagine what PV can do for you, your company, your power challenge. *Power Where You Need It* highlights many ways in which PV is being used

right now—but its future is limitless. PV is truly a clean, competitive and reliable power source for the 21st Century.

## ABOUT THE ORGANIZATION

### *Of This Book*

This book is loosely organized into categories that represent how PV is used, where it is used, and by whom. This necessarily means that a reader will find lighting applications, for example, on several different pages. We mean to stimulate thinking, not structure thinking. The PV pictured here was installed for many different reasons, not all of which have to do with economics. PV is often the power of choice because it reduces greenhouse gases and provides a cleaner environment; it means less dependence on imported resources and helps conserve fossil fuels; it helps companies with their 'green' image and allows users to choose renewables; and it can provide uninterruptible building power.